UGent_Belgium

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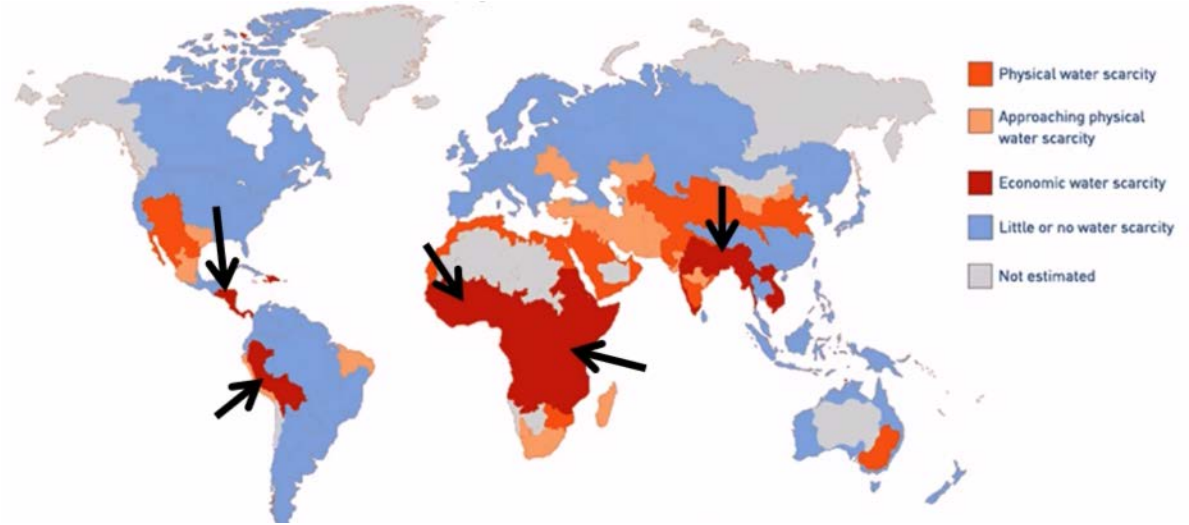
Introduction

Tackle a global problem

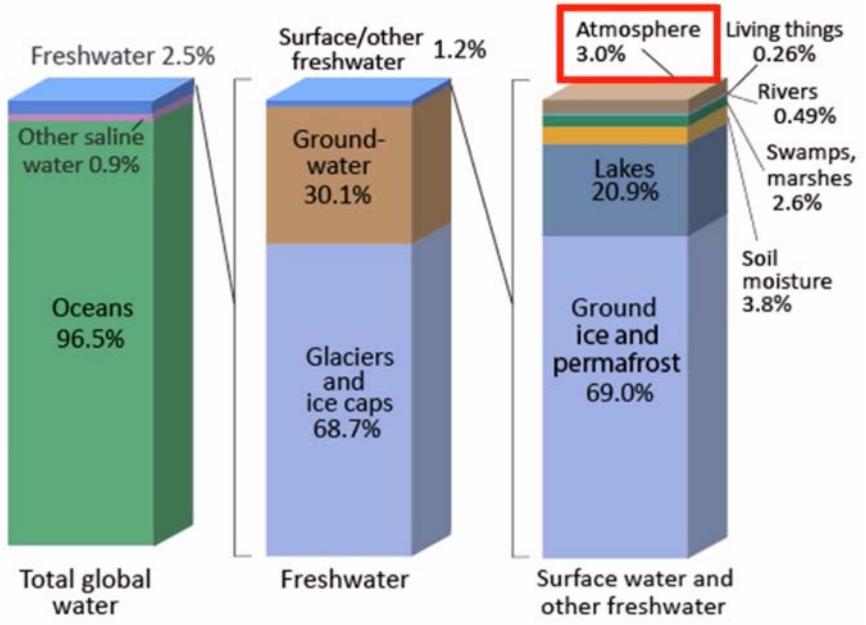
dewpal
Solving water shortage one drop at a time
UGhent Belgium iGEM 2016

Water scarcity



Introduction

Where to get more fresh water?



Strategy

How to harvest atmospheric water?

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Solving water shortage one drop at a time
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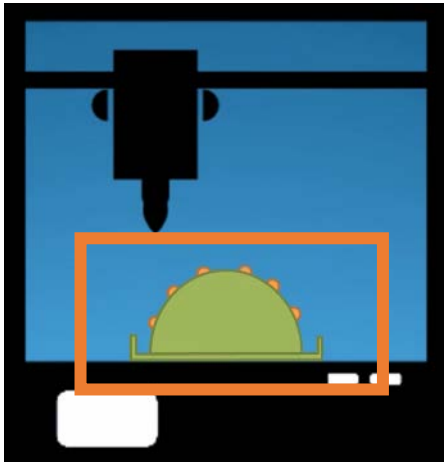
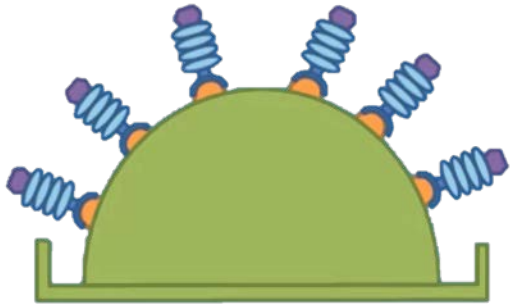
Create 3D-printed optimized shape for water condensation and collection

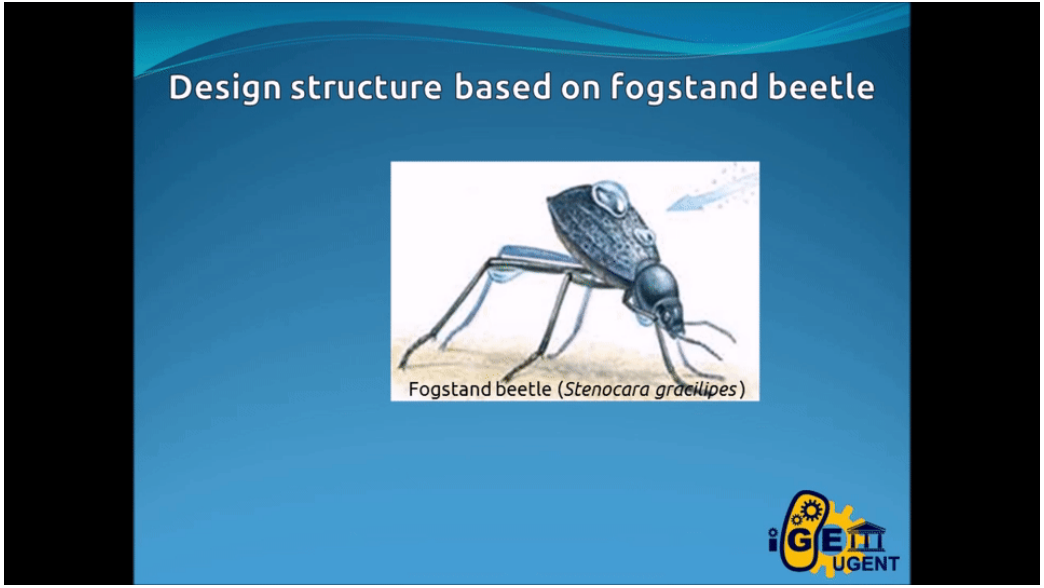


Coat with biological nucleation proteins to improve water condensation



Strategy

3D-printed optimized shape for water condensation and collection



Strategy

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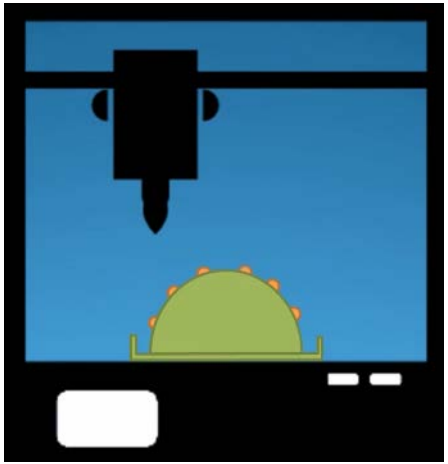

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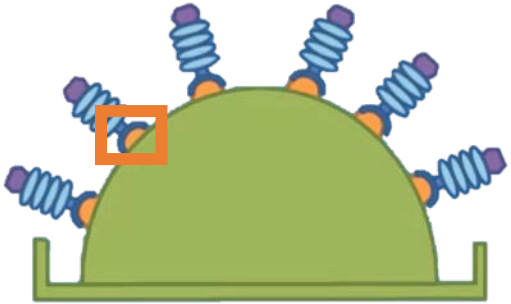
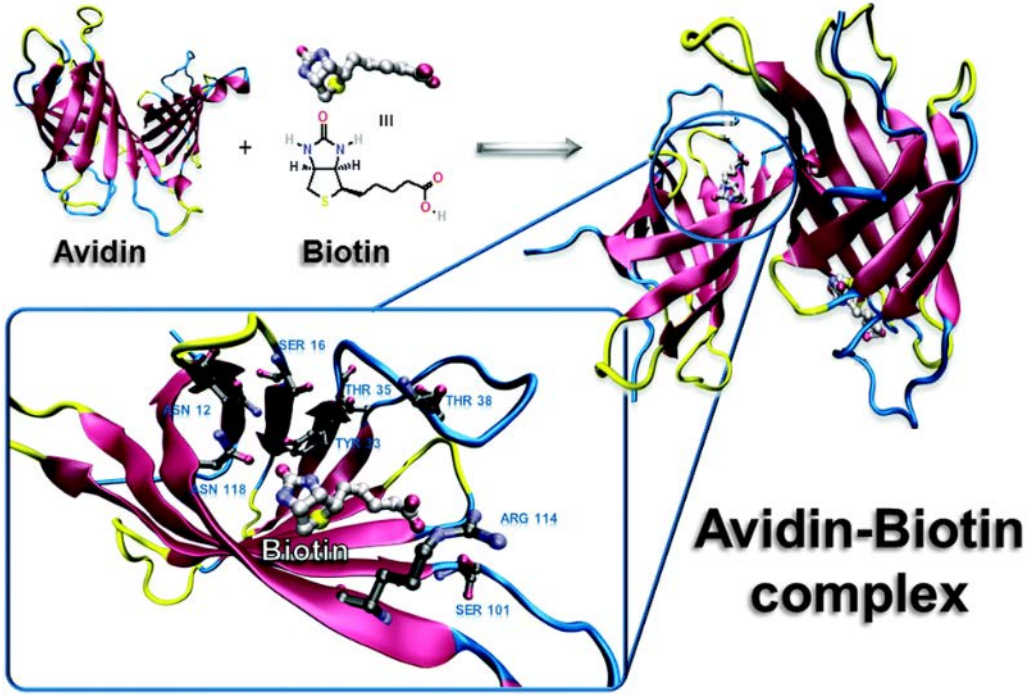


Strategy

How to coat a protein on a printed structure?



- **PLA + biotine**

- **Fusion protein with streptavidin**

Strategy

How to harvest atmospheric water?

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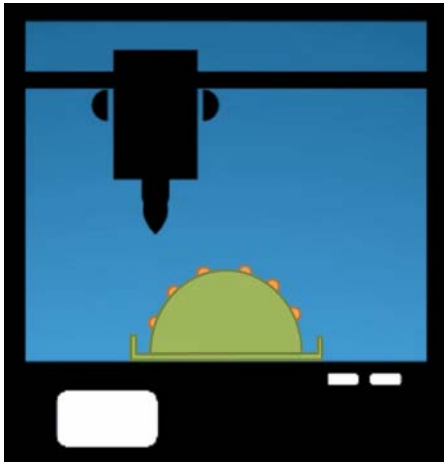
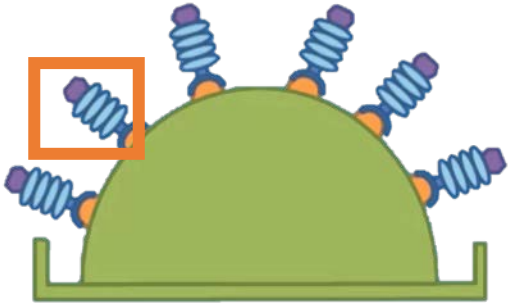
Create 3D-printed optimized shape for water condensation and collection



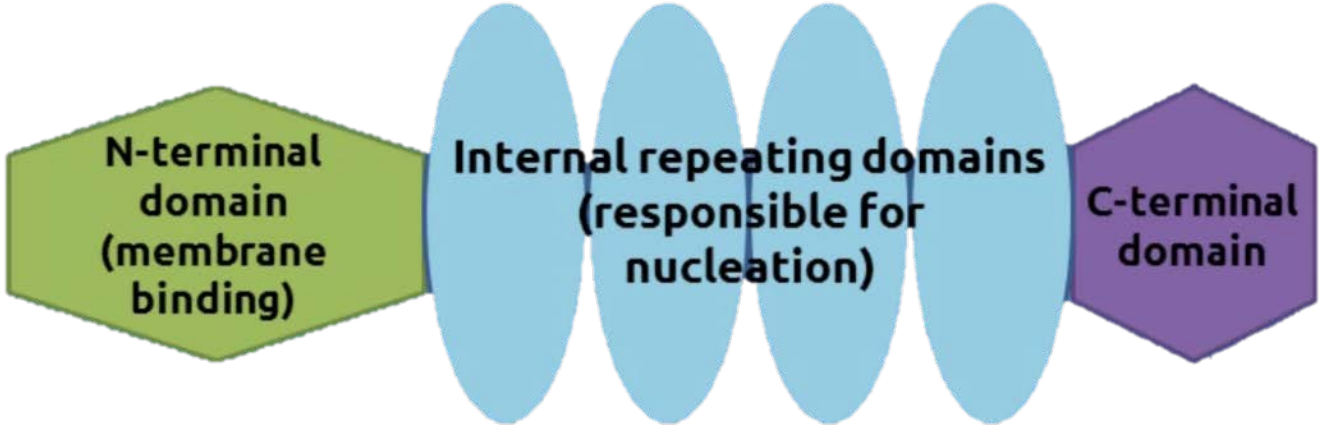
Coat with biological nucleation proteins to improve water condensation



Strategy

Condensation promoting protein?

… meet the *Pseudomonas syringae* **Ice Nucleating Protein** (INP)



Strategy

Condensation promoting protein?

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… meet the *Pseudomonas syringae* **Ice Nucleating Protein** (INP)

Microbial Showers…

The Rain-Making Bacteria

Jay Hardy, CLS, SM (ASCP)

Jay Hardy is the founder and CEO of Hardy Diagnostics. He began his career in microbiology as a Medical Technologist in Santa Barbara, California.

In 1980, he began manufacturing culture media for the local hospitals. Today, Hardy Diagnostics is the third largest media manufacturer in the U.S.

During a cloudburst we often say that it's raining "cats and dogs". In reality, it's actually raining bacteria; a natural phenomenon that presents no cause for alarm. The sky, once thought of as a sterile void, is actually teeming with bacteria, which are vital for watering the plants below.

Biological precipitation, or the **"bio-precipitation"** cycle as it is called, starts when bacteria form colonies on the surface of plants. Winds will then sweep the bacteria into the atmosphere, and ice crystals form around them. Water molecules clump onto the crystals, making them bigger and bigger. The ice crystals turn into rain or snow and fall to the ground. When precipitation occurs, the bacteria have the opportunity

Nuclei are the seeds around which ice is formed. Snow and most rain begin with the formation of ice in clouds. Dust and soot can also serve as ice nuclei. But biological ice nuclei are different from dust and soot nuclei because only these biological nuclei can cause freezing at warmer temperatures.

The bacteria that make it rain

Posted by sedeer in Bacteria, Microbiology, Plants ≈ 12 Comments

Strange as it may seem, water doesn't actually freeze at zero degrees. In fact, even at temperatures as cold as -10°C, water still needs help turning into ice. Living creatures of all stripes have learned to take advantage of this curious fact in

Recently *Pseudomonas syringae* was also found in clouds, where it might help the formation of rain by acting as a condenation nucleus

Work packages

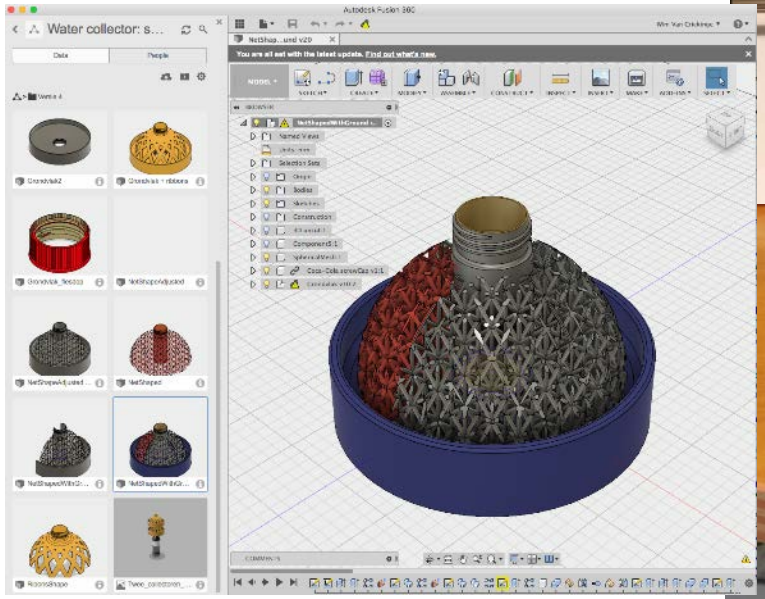
WP1.
Shape

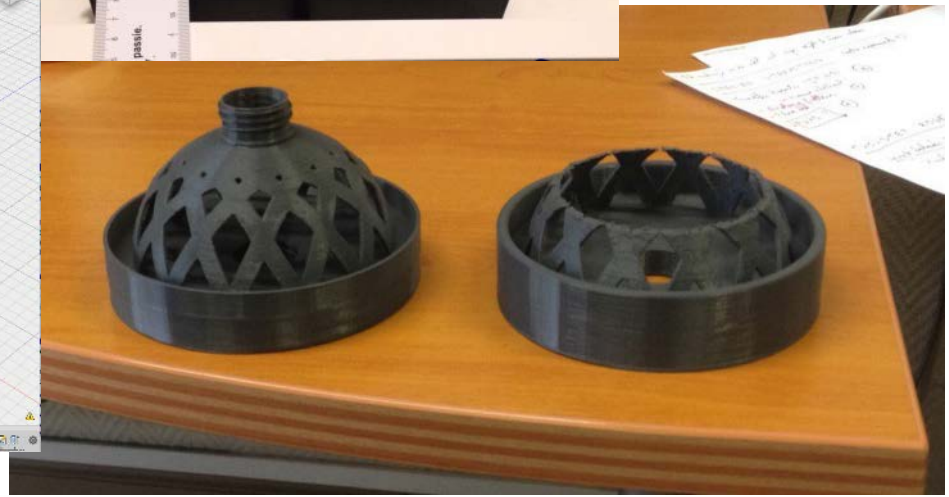
WP2.
Filament

WP3.
BioFunction

WP4.
Functional Assay

WP 1: Shape





WP 2: Filament

Biotinylated PLA

a) Chemical synthesis → too complicated

b) Impregnated and remolten PLA:

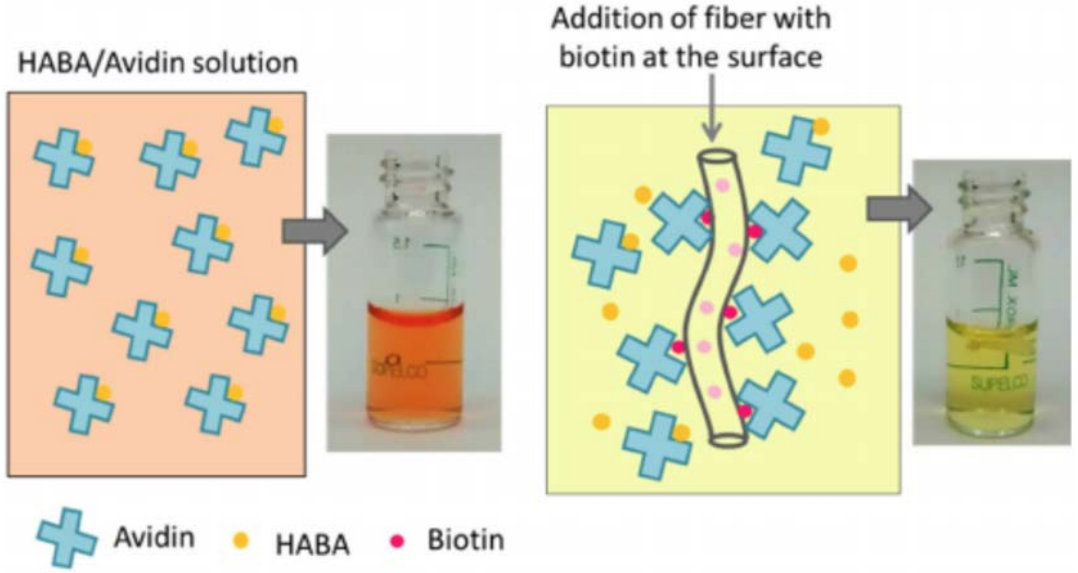
- Dissolve PLA + biotin in hot DMF
- Crash out PLA by adding to EtOH
- Wash with biotin saturated EtOH
- Extrude new filament

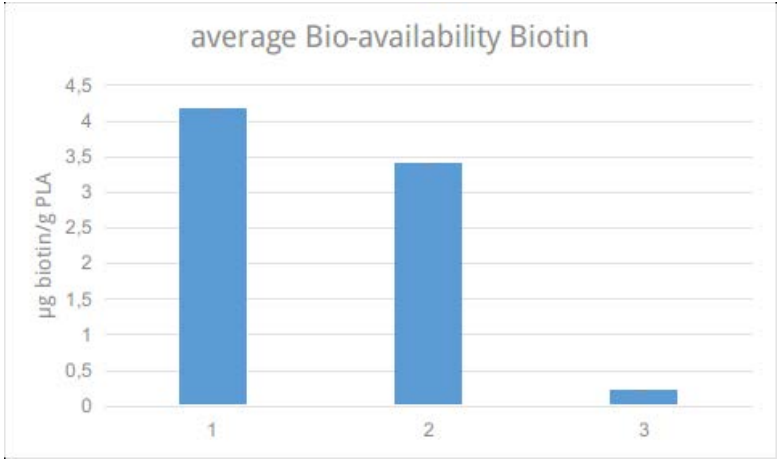
c) Coat with ‘biotin paint’:

- DCM saturated with PLA, suspended biotin

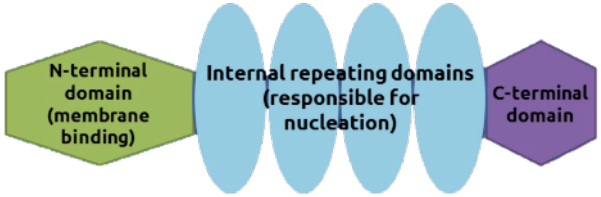
WP 2: Filament

Test for addition of biotin: HABA/avidin assay

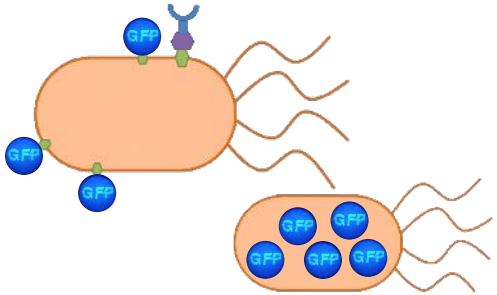
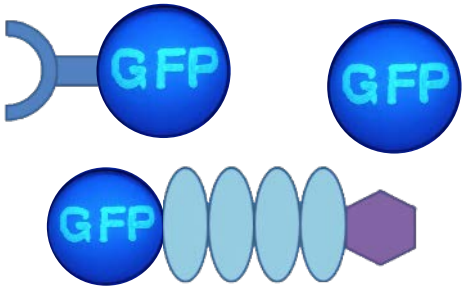
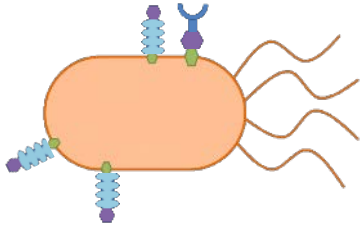
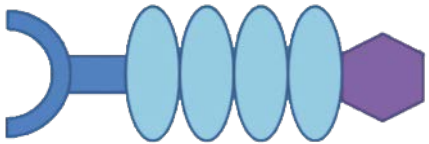




WP 3: BioFunction



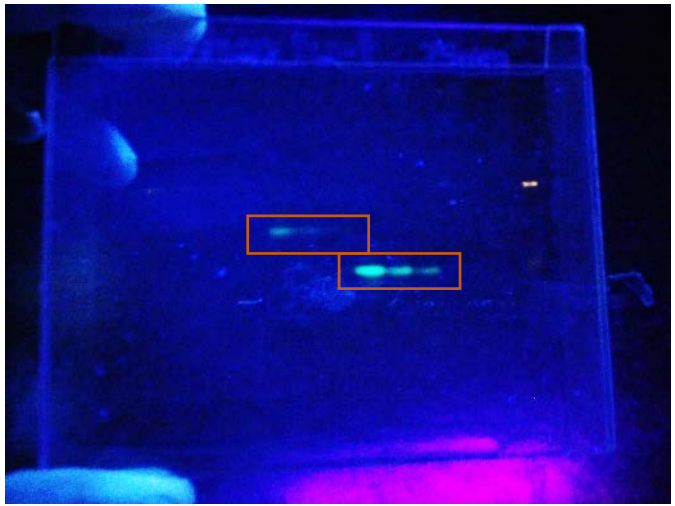
Setup constructs

	Whole-cell	Protein extract
Control		
Functional		

WP 3: BioFunction

The making of …

A monomeric GFPuv (mGFPuv)



A GG-safe Ice Nucleating Protein

WP 3: BioFunction

The making of …

And a truncated Ice Nucleating Protein
(INP-RC fusion proteins with GFP/streptavidin)

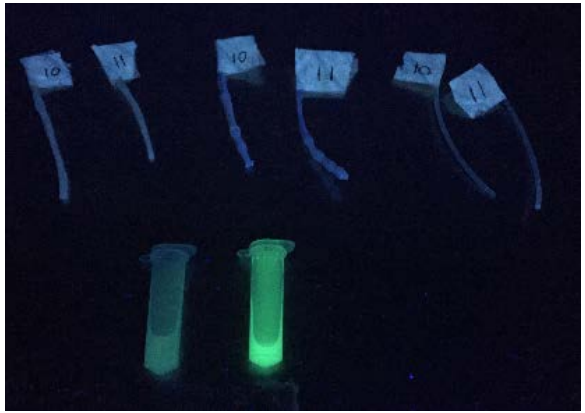
1) inaZ(RC)-mSA2 3) mGFPuv-Strep 5) mGFPuv
2) inaZ(RC)-mGFPuv 4) mGFPuv-mSA2

"Analogous ice forming movie"

WP 4: Functional Assay

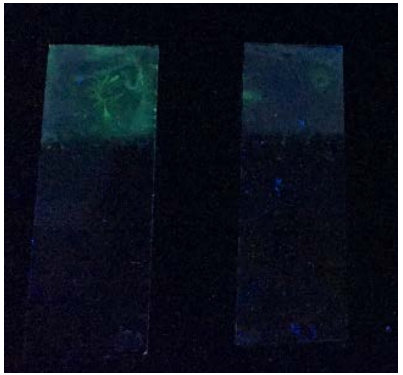
Does it stick?

PLA filament+biotine



10: mGFPuv – mStrep
11: mGFPuv

PLA+biotine coated glass plate



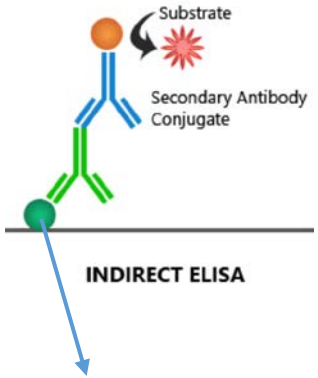
Left: mGFPuv – mStrep ?
Right: a control..

Whole-cell approach no visible fluorescence (data not shown)

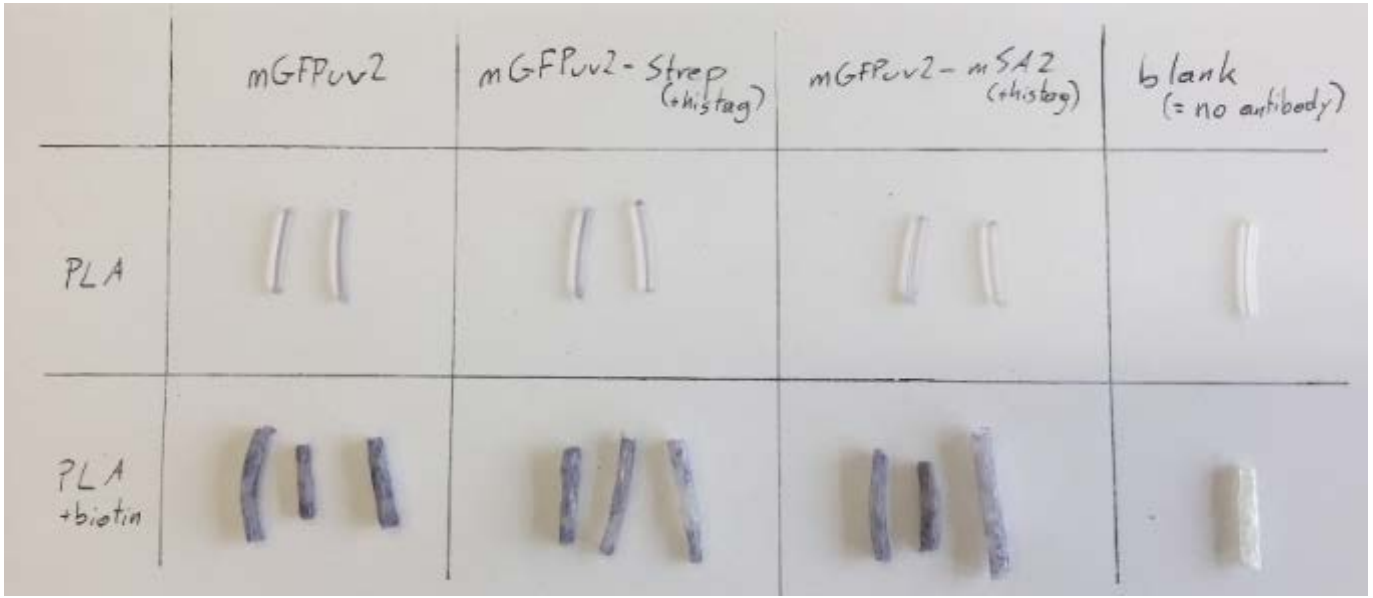
WP 4: Functional Assay

Does it stick?

… a more sensitive assay

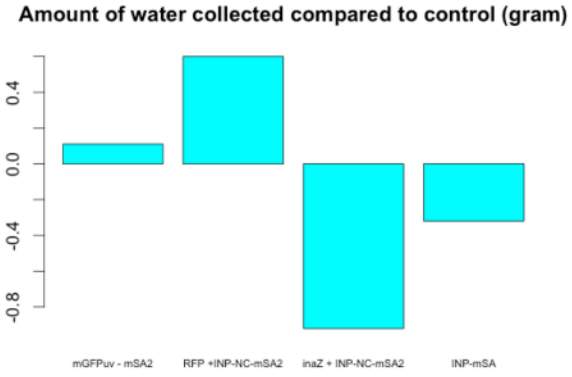


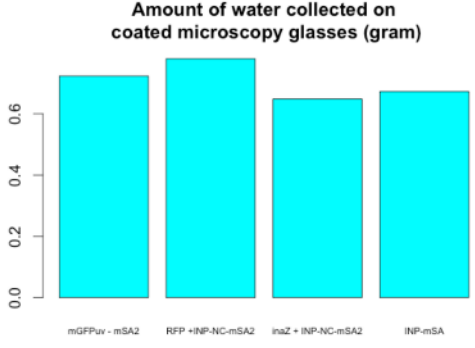
Histag



WP 4: Functional Assay

Does it make water?





dewpal

Solving water shortage
one drop at a time

UGhent Belgium
iGEM 2016

Extraction of atmospheric water using an optimized 3D shape & engineered ice nucleating proteins

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http://2016.igem.org/Team:UGent_Belgium

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CSB Centre for Synthetic Biology

BioBrix

IDT Integrated DNA Technologies

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